CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH

WALTER M. DICKIE, M.D., Director

Weekly Bulletin

SAN FRANCISCO
State Office Building, McAllister and Larkin Streets UNderhill 8700

SACRAMENTO
State Office Building, 10th and L Streets Capital 2800

LOS ANGELES
State Office Building, 217 West First Street MAdison 1271

Entered as second-class matter February 21, 1922, at the post office at Sacramento, California, under the Act of August 24, 1912. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917.

Vol. XIV, No. 38 — October 19, 1935 — GUY P. JONES EDITOR

Protection of the Water Supply of the East Bay Municipal Utility District

By JOSEPH D. DE COSTA, Engineer in Charge of Distribution, East Bay Municipal Utility District

The East Bay cities are supplied with rain and snow water that is caught and stored in artificial reservoirs. As the moisture condenses in the atmosphere and falls to the earth's surface, it begins to absorb impurities. From the atmosphere it dissolves gases and absorbs floating matter, such as particles of dust, bacteria, etc. After it falls on the surface of the earth it comes into contact with mineral and organic matter which is taken up in solution or carried in suspension. The amount and character of such impurities taken up by the water depend upon the character of substances with which the water comes into contact.

The whole history of water, from the time it is precipitated until it finally finds its way back into the air through evaporation, is marked by the absorption of substances which pass into solution or are held in suspension, as well as the precipitation or elimination of the same or other ingredients. Some of these changes are harmless in so far as affecting the ordinary use to which water is put; others are of much consequence, depending upon the requirements to which the water supply is subjected.

WHAT IS GOOD WATER?

For ordinary domestic use the water must be free from infectious or disease-bearing bacteria, physically attractive—that is to say, free from suspended matter and color, free from foreign tastes and odors and free from objectionable minerals. Inasmuch as the most dangerous pollution is connected with human existence, it is apparent that an uninhabited catchment area would produce a water free from water-borne infectious bacteria. However, this would not be assurance that the water would be palatable.

HOW IS OUR WATER MADE SAFE?

In the protection of surface water supplies against unsafe water, four control measures, or lines of defense, may be employed.

1. Protection of the source.
2. Long period of storage.
3. Filtration through an approved sand filter.
4. Disinfection with chlorine or substitutes.

It is generally conceded that any one of these control measures will produce a safe water 98 per cent of the time. The use of two lines of defense will insure a safe water 99 to 99.8 per cent of the time. Most cities employ at least two lines of defense; some are so situated that all four lines of defense can be employed. The East Bay Municipal Utility District employs all four lines of defense, thus assuring consumers water that is safe and palatable at all times.

PROTECTION OF THE SOURCE

The population on the watershed lands is less than two persons per square mile. Trespassing is prohibited. Rigorous sanitary measures are enforced by patrolmen employed by the district. Everything possible is done at the source of supply to prevent contamination of the water.

STORAGE

The reservoirs that store the rain and snow waters for domestic use are large enough to provide long periods of retention, thus furnishing the second line of defense. Water is an unfavorable environment for disease-producing bacteria. Most of these bacteria die within a few weeks after entering the water. The factors affecting their death rate are: sunlight, temperature, sedimentation, and predatory organisms. A quiet body of water is more favorable to the destruction of disease bacteria than a flowing stream.

FILTRATION PLANTS

All of the water supplied by the district is purified by passing it through modern filtration plants. A modern filtration plant comprises aeration, coagulation, sedimentation, and filtration.

Aeration is accomplished by spraying the water into the atmosphere. This releases the pressure and brings the water into intimate contact with the air, causing the foul and odoriferous gases to be evolved, and oxygen to be absorbed. The foul gases, such as hydrogen sulphide, are the by-products of anaerobic decomposition. During the spring and summer months the water in deep reservoirs becomes stratified, the warm water remains on the surface and the cold water, being heavier, stays on the bottom. The aerobic bacteria (bacteria which can live only in air) that decompose the organic matter soon use up the oxygen supply; then the anaerobic bacteria (bacteria which flourish without free oxygen) set in, and their by-products of decomposition give rise to the foul and stagnant odors.

Aeration is very effective in removing odoriferous by-products of decomposition, but comparatively ineffective in removing taste and odor-producing oils secreted by algal growths, "minute plants and animals" which grow abundantly in all open bodies of water to which sunlight gains access. Fortunately, these microscopic organisms have no hygienic significance. They do, however, produce tastes and odors that, unless controlled, may be a source of great annoyance to the water consumers.

Surface waters as a rule carry foreign matter, both organic and inorganic, in suspension, i.e., floating in the body of the water. The large particles of sediment will settle out in a quiet body of water, but the smaller particles, especially those of colloidal dimensions (jelly-like form) never settle out unless coagulated. Often there are enough of these colloidal particles present to give the water a turbid or muddy appearance the year round. To clarify such a water requires the addition of a coagulant, a chemical which will gather the particles. The district uses aluminum sulphate $Al_2(SO_4)_3$. This chemical is applied to the water in dosages varying from 0.5 to 4 grains per gallon, depending on the amount of turbidity and organic matter present. One grain per gallon is equivalent to 143 pounds per million gallons. A series of chemical reactions take place between the aluminum sulphate and the bicarbonates normally in the water that finally result in an insoluble aluminum hydroxide precipitate. When first formed this precipitate is of colloidal dimensions, but thorough and gentle mixing will cause the fine particles to collide and stick together until large flocculent (flaky) masses are formed that will settle out readily. The foreign matter in suspension, particularly the inorganic, is gathered by the precipitate during its formation and also settled out. It is possible in this way to produce a sparkling, clear water from one that is extremely muddy.

After the water is thoroughly coagulated, which requires a period of ten to twenty minutes, it is admitted into large sedimentation basins, where the velocity of flow is low enough to permit the flocculent masses to settle to the bottom, leaving a clear liquid on the surface. A period of retention of about three hours is provided in the sedimentation basins. Normally, about 85 per cent efficiency is obtained by coagulation and sedimentation; that is to say, 85 per cent of the foreign matter in suspension is removed by this process.

The relatively clear liquid is continually drawn from the sedimentation basins on to the sand filter beds, where the remainder of the suspended matter is strained out. The ordinary rapid sand filter, as employed by the district, consists of a rectangular concrete box with an area of about 600 square feet and a depth of about ten feet. On the floor of the filter, three-inch perforated pipe is laid to form a gridiron or network. All of the small pipes are connected to a large collector or outflow pipe. These large collector pipes in turn connect into a larger pipe that conveys the filtered water from all of the units to a filtered water reservoir. On top of the network of small, perforated pipe is placed twenty inches of graded gravel varying from about three inches in diameter at the bottom to one-eighth inch diameter at the top. On top of the graded gravel is placed about thirty inches of relatively fine beach sand. Directly above the sand, concrete or steel

troughs are placed, which empty into a channel that is connected to a wasteway.

The settled water is admitted to the top of the filter, whence it percolates downward through the sand and gravel. It is collected in the bottom by the network of perforated pipe and conveyed to the filtered water reservoir. The filtered product is always crystal clear, irrespective of the character of raw water. Most of the straining action takes place on the top six inches of sand. When the sand becomes clogged so that the water will no longer percolate at the desired rate, the flow through the filter is reversed and filtered water under pressure is admitted at the bottom of the filter through the same network of pipes by a suitable valve arrangement. The velocity of the upward flow is great enough to raise the mud into the troughs which convey it to the wasteway. The filters are washed once or twice each twenty-four hours.

DISINFECTION

Chlorine gas is applied to the water just before it enters the filtered water reservoir. The dosage varies with the character of water being treated and is controlled by sensitive tests that are made frequently by the operator. Chlorine is added primarily as a safety measure. Bacterial analyses show that the water is perfectly safe for human consumption without disinfection most of the time; nevertheless, every drop of water is disinfected before delivery to the consumer. Chlorination provides a cheap insurance against an unsafe water.

PURIFICATION IS CONTROLLED

The various steps in the purification of the water are under laboratory control. The physical, chemical, bacteriological, and biological characteristics of the water are under continued observance from the time the water arrives at the storage reservoirs until it is delivered to the consumer. The district maintains two fully equipped laboratories. Chemical analyses and bacterial and biological examinations are made of samples of water collected regularly at strategic points. The laboratory records show that the standard of purity maintained in the district's water supply exceeds, by a big margin, the standard of purity promulgated by the United States Public Health Service and other governmental agencies for public water supplies.

The diseases commonly transmitted by water are typhoid, cholera, and dysentery. These diseases all originate in man's intestinal tract. It is difficult to isolate the organisms causing typhoid and cholera in routine laboratory work, so it is an accepted practice to use colon bacilli as an index of sewage pollution. Colon bacilli are found in the intestinal tracts of all warm blooded animals, as well as in humans; consequently, a positive reaction for the colon bacillus group is not necessarily indicative of serious contamination; moreover, even though the colon bacilli are of intestinal origin it does not necessarily mean that the water is unsafe. However, it is standard water works practice to accept the presence of B. coli as indicative of sewage pollution. Furthermore, if the colon bacilli are present it is assumed that infectious bacteria are also present and the water is regarded as unfit for human consumption. It is therefore apparent that, although bacterial analysis of a sample of water does not furnish positive evidence of dangerous pollution, the interpretation of the results is very much on the safe side.

EAST BAY WATER IS SAFE

Over 10,000 bacterial examinations are made each year of samples of water collected from representative points throughout the system. The treated waters leaving the filtration plants are always sterile. All pipe lines installed in the system are thoroughly disinfected with chlorine, flushed, filled with clean water and a bacterial examination made of the water before they are placed in service. At times the manipulation of gate valves in the system reverses the flow in pipe lines which brings deposited sediment into suspension and makes the water slightly turbid. Also, the tar coating on the inside of new pipe may impart a foreign taste to the water for several days, but neither of these in any way affects the bacterial safety of the water. The safety of the East Bay district's water supply, however, is best illustrated by the total absence of water-borne infectious diseases in the community.

The policy of the district is to enforce strict sanitary regulations on its watershed lands and to so operate its purification plants that the public water supply shall at all times be absolutely safe and attractive for human consumption, and suitable for all domestic and industrial uses.

No enterprise in the wide range of human experience can rank with training the mind. If, therefore, we have received from heaven nothing so good as the mind, what should be more worthy of exercise and cultivation? No other adventure is to be compared with it. Through it civilization and all man's higher achievements have been won. The report of a gun does not carry so far as the music of the lyre. To pursue intellectual ideals, unlike the privilege of galloping with a king in a royal game park, is a glorious adventure open to every man who cares to live richly and well.—Leon J. Richardson.

MORBIDITY

Complete Reports for Following Diseases for Week Ending October 12, 1935

Chickenpox

116 cases: Alameda 1, Berkeley 16, Oakland 5, Calaveras County 2, Pinole 1, Walnut Creek 1, Fresno 4, Reedley 2, Lake County 1, Los Angeles County 3, Alhambra 1, Burbank 1, Glendale 3, Los Angeles 8, Montebello 1, Pomona 1, Sierra Madre 1, South Pasadena 1, Marin County 15, San Rafael 2, Merced County 1, Monterey County 1, Anaheim 2, Santa Ana 1, Sacramento 1, San Diego 6, San Francisco 22, Stockton 3, Santa Barbara County 4, Santa Barbara 3, Palo Alto 1, San Jose 1.

Diphtheria

51 cases: Livermore 1, Oakland 6, Fresno County 2, Imperial County 4, Brawley 2, Los Angeles County 3, Burbank 1, Los Angeles 16, Pasadena 1, Riverside 2, Sacramento 1, Redlands 1, San Diego 3, San Francisco 1, Stockton 1, Santa Barbara County 1, Santa Cruz 1, Stanislaus County 1, Tulare County 2, Marysville 1.

German Measles

27 cases: Alemeda 1, Berkeley 2 ,Oakland 3, Fresno 1, Glendale 1, Long Beach 1, Los Angeles 6, Santa Monica 1, Sierra Madre 1, King City 1, Grass Valley 1, Tustin 1, San Francisco 4, Daly City 2, Palo Alto 1.

Influenza

20 cases: Bakersfield 1, Lake County 2, Los Angeles 11, Pasadena 1, Nevada County 1, Santa Ana 1, Riverside 1, San Francisco 1, San Jose 1.

Malaria

8 cases: Brawley 2, Los Angeles 2, San Fernando 1, Yuba City 2, Marysville 1.

Measles

125 cases: Alameda County 2, Alameda 1, Oakland 2, Concord 1, Crescent City 1, Fresno 2, Los Angeles County 2, Glendale 1, Inglewood 1, Long Beach 2, Los Angeles 20, Redondo 3, Monterey Park 1, Madera 2, Marin County 6, Monterey County 8, Pacific Grove 15, Salinas 2, Corona 1, Sacramento 3, Oceanside 1, San Diego 1, San Francisco 27, Daly City 2, Lompoc 1, Santa Clara County 2, Palo Alto 1, Santa Clara 7, Yolo County 1, Woodland 6.

Mumps

186 cases: Alameda County 2, Berkeley 10, Emeryville 7, Oakland 33, Colusa County 1, Contra Costa County 13, Fresno County 13, Kern County 8, Los Angeles County 6, Alhambra 1, Burbank 1, Culver City 1, Glendale 1, La Verne 2, Long Beach 6, Los Angeles 13, Pomona 1, Sierra Madre 4, Whittier 1, South Gate 1, Merced County 3, Merced 2, Grass Valley 1, Santa Ana 4, Riverside 2, Sacramento 15, San Bernardino County 2, San Diego County 2, Escondido 2, San Diego 1, San Francisco 3, San Diego County 3, Stockton 7, San Luis Obispo 3, San Jose 1, Santa Cruz 1, Sierra County 2, Turlock 2, Sutter County 2, Ventura County 1, Yolo County 2.

Pneumonia (Lobar)

37 cases: Berkeley 1, Oakland 1, Butte County 1, Pittsburg 1, Fresno 1, Los Angeles County 1, Los Angeles 11, Hawthorne 1, Orange County 1, Placentia 1, Riverside 1, San Bernardino County 1, San Diego 3, San Francisco 6, Sunnyvale 1, Petaluma 1, Woodland 1, California 3.*

Scarlet Fever

161 cases: Alameda County 1, Berkeley 2, Oakland 5, Butte County 1, Gridley 4, Colusa County 2, Contra Costa County 1, Concord 1, Fresno County 3, Fresno 3, Sanger 1, Selma 1, Imperial County 3, Kern County 6, Lemoore 1, Los Angeles County 13, Alhambra 1, Glendale 1, Inglewood 1, Long Beach 3, Los Angeles 27, Montebello 1, Pasadena 2, Santa Monica 1, Maywood 1, Chowchilla 1, Marin County 1, Merced County 1, St. Helena 1, Nevada County 2, Grass Valley 2, Orange County 5, Brea 1, Fullerton 1, Riverside County 2, Elsinore 1, Sacramento County 1, Sacramento 3, San Bernardino 1, Chula Vista 2, La Mesa 2, San Diego 6, San Francisco 9, San Joaquin County 3, Manteca 1, Stockton 1, Tracy 1, San Mateo County 6, Atherton 1, Santa Barbara County 3, Santa Maria 1, Santa Clara County 5, Santa Clara 1, Sunnyvale 1, Vallejo 1, Ceres 2, Trinity County 1, Tulare County 1, Ventura 2, California 2.*

Smallpox

No cases reported.

Typhoid Fever

21 cases: Oakland 1, Fresno County 1, Fresno 2, Imperial County 2, Hanford 2, Los Angeles 2, Madera County 1, Napa 1, Orange 1, San Diego County 2, San Francisco 1, Buringame 1, San Mateo 1, Vallejo 1, California 2.*

Whooping Cough

70 cases: Alameda 1, Berkeley 3, Emeryville 1, Oakland 7, Los Angeles County 7, Alhambra 1, Culver City 1, Glendale 1, Huntington Park 1, Los Angeles 10, Pomona 1, Torrance 2, South Gate 1, Maywood 2, Orange County 1, Orange 2, Redlands 2, San Bernardino 1, Chula Vista 3, San Diego 6, San Francisco 14, Stockton 1, Ventura 1.

Anthrax

One case: San Joaquin County.

Meningitis (Epidemic)

One case: Los Angeles

Leprosy

2 cases: San Francisco.

Dysentery (Amoebic)

4 cases: Oakland 1, Los Angeles 1, San Bernardino County 1, California 1.*

Dysentery (Bacillary)

12 cases: Gridley 1, Los Angeles County 6, Los Angeles 5.

Ophthalmia Neonatorum

2 cases: Riverside County 1, San Francisco 1.

Pellagra

6 cases: Los Angeles 5, San Francisco 1.

Poliomyelitis

26 cases: Fresno County 6, Kern County 2, Los Angeles County 4, Glendale 1, Long Beach 1, Los Angeles 3, Orange 1, Stanislaus County 1, Tulare County 5, California 2.*

Tetanus

One case: Los Angeles.

Trachoma

12 cases: Huntington Beach 2, San Diego County 4, National City 1, Santa Maria 5.

Encephalitis (Epidemic)

3 cases: Richmond 1, Fresno 1, Sacramento 1.

Paratyphoid Fever

One case: Riverside.

Trichinosis

4 cases: San Francisco.

Food Poisoning

16 cases: Los Angeles County 10, Pasadena 4, South Gate 1, Santa Maria 1.

Undulant Fever

3 cases: Humboldt County 1, Glendale 1, Long Beach 1.

Tularemia

One case: San Joaquin County.

Coccidioidal Granuloma

2 cases: Fresno 1, Los Angeles County 1.

Septic Sore Throat (Epidemic)

2 cases: Alameda 1, Redwood City 1.

Rabies (Animal)

7 cases: Contra Costa County 1, Los Angeles County 1, Beverly Hills 1, Los Angeles 1, San Diego 1, San Joaquin County 1, Stockton 1.

Fire is latent within each of us, but it takes the right spark to make it flame. Coming to know some of the best members of our race, we learn how to think and how to live.—Leon J. Richardson.

---

* Cases charged to "California" represent patients ill before entering the state or those who contracted their illness traveling about the state throughout the incubation period of the disease. These cases are not chargeable to any one locality.

25118 10-35 6M

CALIFORNIA STATE PRINTING OFFICE